PENOBSCOT RIVER

AND

BUCKSPORT HARBOR

MAINE

SURVEY

(REVIEW OF REPORTS)

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

JANUARY 1974

DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, D.C. 20314

IN REPLY REFER TO

DAEN-CWP-A

SUBJECT: Penobscot River, Maine

THE SECRETARY OF THE ARMY

1. I submit for transmission to Congress the report of the Board of Engineers for Rivers and Harbors, accompanied by the report of the Division Engineer, in response to a resolution of the Committee on Public Works of the United States Senate, adopted 3 September 1963, requesting a review of the reports of the Chief of Engineers on Penobscot River, Maine, with a view to determining whether the existing project should be modified in any way at the present time.

2. The Division Engineer finds that modifications to provide increased depths and related improvements are not economically justified. Accordingly, he recommends that no further modification of the existing project on the Penobscot River, Maine, be undertaken at this time.

3. The Board of Engineers for Rivers and Harbors, concurring in the findings of the reporting officer, reports that modification of the existing navigation project on the Penobscot River, Maine, is not advisable at this time.

4. I concur in the views of the Board.

W. C. GRIBBLE, JR.
Lieutenant General, USA
Chief of Engineers

DAEN-BR (3 Jan 74) 1st Ind
SUBJECT: Survey (Review of Reports) on Penobscot River, Maine

Board of Engineers for Rivers and Harbors, Fort Belvoir, Virginia, 22060
5 June 1975

TO: Chief of Engineers, Department of the Army

1. The Division Engineer issued a public notice stating his findings and recommendations and affording interested parties an opportunity to present additional information to the Board. Careful consideration has been given to the communications received.

2. The reporting officer finds that no additional improvements in the interest of navigation on the Penobscot River are advisable at this time. He has carefully considered the type and level of waterborne commerce as well as the anticipated growth of such commerce, and concludes that the existing Federal navigation project on Penobscot River is adequate to meet foreseeable future requirements.

3. The Board finds that reevaluation of the project under the guidelines provided in the Water Resources Council's Principles and Standards for evaluating such projects, which became effective 25 October 1973, would not change the findings of the survey report, and, concurring in the findings of the reporting officer, reports that Federal participation in further navigation improvements on the Penobscot River, Maine, is not advisable at this time.

FOR THE BOARD:

/s/D. A. Raymond
D. A. RAYMOND
Major General, USA
Chairman

SYLLABUS

At a public meeting held at Bangor, Maine in 1968, State and local government officials, shipping interests, business representatives and other local interests concerned with navigation improvements in Penobscot River requested that the Federal navigation project in this waterway be further improved to meet current and anticipated future needs of commercial navigation. The plan of improvement requested at the public meeting and at subsequent meetings with interested parties included dredging a river channel from Penobscot Bay to Bangor to a depth of 40 feet at mean low water, and removing rock pinnacles at the mouth of the river opposite Sandy Point.

In response to these requests, all known commercial users of the waterway were individually interviewed and were asked to present data showing their need for the desired improvements and their intent to utilize an improved waterway to the greatest extent practicable. Only one company was able to provide the necessary data. Some minor benefits such as decreased tidal delays and a reduction in tug assistance were developed in the course of the study; however the overall benefits to be derived are far short of those necessary to economically justify the cost of the improvement.

Since investigations clearly indicated that any improvement of the river channel would have to be justified by prospective commerce, local interests were afforded the opportunity to examine potential growth of industries within the communities bordering the river and the possibility of attracting new industries which would be dependent upon this waterway for receiving or shipping goods. Four years of local efforts have resulted in no new data which favorably adds to project justification.

An assessment of the prospects for future port-related activities was undertaken, including an examination of available economic and technical data, which would indicate the potential demand to be made of the waterway. These efforts produced no particular activity which would justify construction of the improvement.

In investigating the practicability of removing the rock pinnacles opposite Sandy Point, it was determined that a satisfactory solution to the navigational uncertainties presented by the pinnacles was the relocation of existing aids to navigation. Since site conditions preclude the installation of a permanent marker on the pinnacles, and

since the existing natural channel depth and width adjacent to this area are adequate for existing and prospective commerce, the relocation of existing buoys to best mark this channel to divert traffic around the ledge area provides an acceptable solution to this problem. This decision was reached with the concurrence of the U. S. Coast Guard and local river pilots.

Accordingly, the Division Engineer recommends no modification of the existing Federal navigation project in Penobscot River at the present time.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:

NEDED-R

3 January 1974

SUBJECT: Survey (Review of Reports) on Penobscot River, Maine

HQDA (DAEN-CWP-E)
WASH DC 20314

AUTHORITY

1. This report is submitted in compliance with a resolution adopted 3 September 1963, by the Committee on Public Works of the United States Senate. The resolution reads as follows:

"RESOLVED BY THE COMMITTEE ON PUBLIC WORKS OF THE UNITED STATES SENATE, That the Board of Engineers for Rivers and Harbors, created under Section 3 of the River and Harbor Act, approved June 13, 1902, be, and is hereby, requested to review the reports of the Chief of Engineers on the Penobscot River, Maine, printed as House Document Numbered 652, Seventy-first Congress, third session, and other reports, with a view to determining whether the existing project should be modified in any way at the present time."

The Chief of Engineers assigned the review of reports to the New England Division, on 8 November 1963.

PURPOSE AND EXTENT OF STUDY

2. This study was made to determine the need and economic justification for modifying the existing Federal navigation project in Penobscot River in the interest of commercial navigation. A public meeting was held in the City Hall at Bangor, Maine, on 11 June 1968 to determine the nature and extent of navigation improvements desired by local interests. Subsequent meetings, contacts and correspondence with local officials and commercial users of the river

supplemented the information from the public meeting. Available hydrographic condition surveys, supplemented by surveys of the National Ocean Survey, have been used to estimate quantities and costs of desired improvements. Economic indicators, such as population growth, income, employment and other aspects of the local economy have been examined in this study.

DESCRIPTION

3. The Penobscot River empties into the head of Penobscot Bay, about 90 miles northeast of Portland. The river rises on the northwestern boundary of Maine and flows generally south for a distance of 200 miles, draining an area of 8,570 square miles. The two main branches of the river meet at the Town of Medway about 100 miles north of the mouth of the river. Other tributaries are the Mattawamkeag and the Piscataquis Rivers, and Kenduskeag Stream. The Penobscot River is tidal for 27 miles from the mouth upstream to a dam at Bangor, which marks the head of navigation.

4. The entrance to the river at the head of Penobscot Bay lies between Fort Point on the west and Wilson Point on the east. A natural channel from this point to Verona Island, about 2.5 miles upstream, is 600 feet wide with a minimum depth of 35 feet. Shoal and ledge areas adjacent to this channel present minimum depths of 31 feet.

5. At Verona Island the river divides into two branches passing on either side of the island. The east branch channel winds its way to Bucksport between rocky headlands and over shoaled areas with depths generally ranging from 16 feet to 30 feet. Additional shoals in the east branch channel north of Verona Island have reduced depths of from 8 feet to 13 feet and are the controlling factors which restrict navigation to recreational and other comparatively shallow draft vessels.

6. The west branch channel at Verona Island is the main ship channel, which naturally maintains a minimum depth of 35 feet for widths ranging from 400 feet to 600 feet. The west branch channel, like the eastern channel passes between the rocky headlands of the shore and Verona Island. However, unlike the eastern channel, there are no winding turns to maneuver. The east and west branch channels merge at Bucksport Harbor.

7. Between Fort Point and Bucksport Harbor, there exist two ledge areas of prime importance to deep draft commercial navigation. The first ledge area lies opposite Sandy Point and reduces the available depth to 31 feet. It is at this point that the natural channel width is also reduced from 600 feet to 400 feet while providing a depth of 35 feet. The second ledge area called Odom Ledge is about 2000 yards upstream of Sandy Point. Odom Ledge is part of a large shoal area which further divides the west branch channel southwest of Verona Island. Minimum natural channel width past Odom Ledge and the adjacent shoal area is 400 feet.

8. From Bucksport north to the Town of Winterport, a distance of approximately 5 miles, the shore-to-shore width increases from 1,200 feet to somewhat more than one mile just below Winterport. This wide area, known as Frankfort Flats, has a channel generally about 350 feet wide and 22 feet deep, except for a narrow portion located at Lawrence Cove, just above Bucksport. The portions of the channel in the vicinity of Lawrence Cove and Frankfort Flats are subject to shoaling.

9. The winding ten-mile reach from Winterport to Hampden gradually decreases in shore-to-shore width from 1,500 feet to about 800 feet. The navigable channel depths in this area are generally between 20 and 45 feet, with the channel width ranging from 300 to 1,000 feet.

10. The remaining 5-mile stretch of navigable waterway from Hampden to the twin cities of Bangor and Brewer has an average overall width of 800 feet and channel depths varying from 38 feet at Hampden to 14 feet at Bangor. A controlling depth of 11 feet is located at the up-stream limit of the navigable waterway, just downstream of the highway bridge at Bangor.

11. The mean range of tide varies from 10.3 feet at the mouth to 13.1 feet at the head of navigation. The mean range of tide at various points are: Fort Point, 10.3 feet; Bucksport, 11.0 feet; Hampden, 12.8 feet; and Bangor, 13.1 feet. National Ocean Survey Chart No. 311 shows the river from Penobscot Bay to Bangor.

TRIBUTARY AREA

12. There are eleven large protected embayments in the Penobscot Bay area: Deer Isle Harbor, Castine Harbor, Penobscot River,

Stockton Harbor, Searsport Harbor, Belfast Harbor, Camden Harbor, Rockport Harbor, Rockland Harbor, Tenants Harbor and Thomaston Harbor. In addition there are several smaller harbors, coves and inlets which meet various needs of commercial and recreational activity. Of these embayments, Searsport Harbor, Penobscot River including Bucksport and Bangor Harbors, and Rockland Harbor, are the more important areas of commerce.

13. The climate of Penobscot Bay exhibits changeable weather conditions, having great variations between the same seasons in different years, and wide ranges of temperature. The average annual temperature is generally in the mid-40's, with summer and winter averages of 80 degrees and 33 degrees, respectively. Annual precipitation averages 46 inches on the coast, with 50 to 70 inches of snowfall. Prevailing winds in Penobscot Bay are typically southwesterly in the summer and north-northwesterly in the winter. Storms are generally accompanied by winds from the east and northeast. There are numerous fog days for the upper bay area.

14. The three counties most directly related to and affected by improvements in Penobscot River are Waldo, Hancock and Penobscot counties; however, Aroostook, Washington and Piscataquis counties are affected to a lesser degree. Population data for these counties is summarized in TABLE I.

15. For the period 1950 to 1970 the six county population showed an overall increase of 3.2 percent, or slightly less than 0.2 percent per year. This is compared to an increase of 8.5 percent for the State of Maine during the same twenty year period, or 0.4 percent per year. The United States as a whole showed an average annual population increase of 2.6 percent during the same period. During the 1950's, the six county area had a population increase of 8.3 percent, which compared favorably to Maine's 6.1 percent increase. However, this trend reversed during the 1960's when the six county area population decreased 4.6 percent, accompanied by a state increase of 2.4 percent.

TABLE I

POPULATION TRENDS*

COUNTY	POPULATION			PERCENT CHANGE	
	1950	1960	1970	1950-60	1960-70
Aroostook	96,039	106,064	92,463	+10.4	-12.8
Hancock	32,105	32,293	34,590	+ 0.6	+ 7.1
Penobscot	108,198	126,346	125,393	+16.8	- 0.8
Piscataquis	18,617	17,379	16,285	- 6.7	- 6.3
Waldo	21,687	22,632	23,328	+ 4.4	+ 3.1
Washington	35,187	32,908	29,859	- 6.5	- 9.3
Six-County Area	311,833	337,622	321,918	+ 8.3	- 4.6
State of Maine	913,774	969,265	992,048	+ 6.1	+ 2.4
United States	151,326,000	180,671,000	204,879,000	+19.4	+13.0

*Source - U. S. Department of Commerce

16. The six county area discussed above is one of twenty-three water resource planning areas in several eastern states as delineated in the North Atlantic Region Water Resource Study prepared by the Office of Business Economics, Department of Commerce. Entitled The Bangor, Maine, Water Resources Planning Area (BWRPA), it is located in the northernmost corner of the North Atlantic Region. The population density of the BWRPA is the lowest of the twenty-three areas, less than one-tenth of the North Atlantic Region average, and it has been growing more slowly than the region. The major city, Bangor, with a 1970 population of 33,168, down 15 percent from a decade earlier, is located in the southern end of the BWRPA. A one time center of the nation's lumber industry in the late 1800's, the City of Bangor has attempted to keep pace with modern development by becoming a manufacturing center.

17. Employment in the Bangor area is heavily dependent upon the rich natural resources of the area, both directly and indirectly. There is a high concentration of jobs in agriculture, forestry and fisheries, and in the manufacturing industries that process these commodities. Paper and allied products are the most significant manufacturing industries, accounting for about eight percent of total employment and one-quarter of all manufacturing employment. The lumber and wood products industry is the second major employer, having held first position until the mid 1950's. Food and textile product industries are also important to the area. The fastest growing manufacturing industries in the 1950's and 1960's were chemicals, non-electrical machinery, printing and apparel.

18. In the Hancock, Penobscot and Waldo tri-county area, manufacturing employment has been sensitive to national economic trends. Large manufacturing concerns have opened plants in the area during limited periods of high production and have closed them when overall production levels declined. From 1966 to 1971, the number of workers in manufacturing industries declined from 16,600 to 14,200, down 14.5 percent.

19. The Bangor Water Resources Planning Area is a relatively poor area with the lowest per capita income in the North Atlantic Region being only two-thirds of the national average, while for the region as a whole the figure is 114 percent. However, average income is expected to approach the national average, though remaining below, since population is expected to grow at only two-thirds the North Atlantic Region rate while total personal income is expected to grow at a rate

closer to the region's rate. Likewise, total employment is expected to remain below the region average.

20. For manufacturing industries in the tri-county area the average gross wage is about $6,600 while the average gross wage in non-manufacturing segments of the economy is about $5,300. In both cases, average wage figures are slightly higher in Penobscot County and lower in Waldo County.

21. The close economic relationship between the six counties is based upon transportation patterns and the role of Bangor as the economic center of the region. Major agricultural activities are the poultry and egg industry in Waldo County, and the dairy and crop industry, particularly potatoes, in Aroostock County. Despite a decline in the number of farm workers and total farm acreage, the growth of commercial poultry has contributed to the steady increase in farm production for the region.

22. Commercial fishing in the Penobscot Bay area accounts for about one-half of the total fish and shellfish production in the State of Maine; about 143 million pounds valued at about $31 million in 1971. The most valuable fishing resource is the Maine lobster, whose 1971 landings approach $17.5 million of which $13 million were attributed to catches landed in the Penobscot Bay area.

23. Mining, although not a leading industry, does contribute to the economy of the six-county area. Sand and gravel, stone, zinc and copper represent the major minerals produced in the area and account for roughly $10 million of a statewide total of $23.8 million worth of all minerals mined in 1970. New deposits of nickel-copper and copper-silver have recently been located in the state, and further exploration is occurring.

24. The preceding industries comprise the bulk of the area's industrial and economic base. In terms of value of product, manufacturing is the leading contributor to the area's economic activity.

25. The upper Penobscot Bay and River area is served by all major forms of freight and passenger transportation which connect the area with other industrial and economic centers of the northeastern United States and Canada. The area is served by three railroads: the Maine Central; the Bangor and Aroostook; and the Belfast and Moosehead Lake Railroad. Maine Central Railroad offers service via Brunswick

to Portland and beyond to the south. Various branch lines connect Bangor with other large communities including Bucksport and Ellsworth. Principal commodities handled by Maine Central are petroleum, moved from vessels at Bucksport to Bangor, cement from Thomaston, and grain products from the Midwest for poultry farms.

26. The Bangor and Aroostook Railroad serves the northern half of the Bay Area with a line between Bangor and Searsport and connections to the Maine Central, Canadian National and Canadian Pacific Railroads to the north. Major commodities handled by the Bangor and Aroostook Railroad at Searsport include petroleum products shipped to points throughout Central and Northern Maine, paper being exported by inland producers, and chemicals for the paper industry. The Belfast and Moosehead Lake Railroad is a major carrier of grain for poultry feed, and connects Belfast to the large Northeastern and Canadian markets via the Maine Central line at Burnham.

27. The area is served by a network of highways including U. S. Route 1 to the east and south, Interstate 95 to the north and south, and U. S. Route 2 to the west. Other primary routes which converge in the Bangor-Brewer area provide a means for rapid overland freight service throughout the state. The alignment of U. S. Route 1 along the coastline connects urban areas containing over 50 percent of the area's population. The City of Bangor is served by 16 overland truck carriers, 10 of which have terminals in Bangor, and several having routes to the Canadian Maritime Provinces and into the Washington, D. C.-Philadelphia area. Truck freight leaving Bangor at night arrives at New York the following morning and at Philadelphia within 24 hours.

28. Bangor International Airport was established in 1968 following deactivation by the U. S. Air Force of the former Dow Air Force Base. The new $100 million civilian jet installation is owned and operated by the City of Bangor. The airport lies directly beneath the North Atlantic Great Circle Air Route to Europe used by most European-New York air traffic. Since mid-1968 the airport has developed as a major East Coast technical service stop for many scheduled and supplemental carriers hauling transatlantic passengers and freight. International flights stopping at Bangor have grown from 56 in 1968 to 2,424 in 1971 with nearly 400,000 international travelers having stopped over at Bangor in 1971. Domestic air service ties the region to all major population centers in the country.

Flight facilities include a 24-pit underground fuel distribution system and a 2.5 million gallon fuel tank farm. The 11,400 foot-long runway provides the capability of handling the newest generation of jet planes in use today.

BRIDGES

29. Five bridges span Penobscot River from its mouth at Fort Point to the head of navigation at Bangor. Physical data on these bridges are given in TABLE II proceeding upstream from Fort Point. Two additional bridges crossing the mouth of Kenduskeag Stream in Bangor are also included in TABLE II.

TABLE II

BRIDGE CHARACTERISTICS

Miles above Mouth	Location	Type	Channel Span	Height MHW	Use
6.8	Prospect	Fixed	750'	135'	Highway
7.7	Bucksport	Fixed	65'	17'	Highway
26.4	Bangor-Brewer	Fixed	152'	22'	Highway
26.8	Bangor-Brewer	Fixed	195'	23'	Highway
26.9	Bangor-Brewer	Swing	39'	22' (closed)	Railroad
26.5	Kenduskeag Stream	Swing	40'	6' (closed)	Railroad
26.6	Kenduskeag Stream	Fixed	30'	8'	Highway

PRIOR REPORTS

30. The Penobscot River, including Bucksport Harbor, and Bangor Harbor, have been the subject of several reports dating back to 1866. The essential reports and accompanying descriptive data are listed in TABLE III.

TABLE III

PRIOR REPORTS

Survey Authority	Feature	Document	Project Authority
R & H Act Aug. 2, 1882	Widening of channel at Bangor 100' for distance of 4,500' to 14' depth (mlw); widen channel near Crosby Narrows to min. width of 250' and 12' depth (ext. lw)	Sen. Ex. No. 44 48th Cong. 1st Sess.	R & H Act July 5, 1884
R & H Act Aug. 5, 1886	Channel 22' deep (mlw) by 400' wide between Winterport and Bucksport-about 6 miles -construction of 5 jetties	H. Ex. No. 133 50th Cong. 1st Sess.	R & H Act Aug. 11, 1888
R & H Act Sept. 19, 1890	Further widening of 60' at Bangor, construction of 2 jetties at Crosby Narrows - 3 jetties between Winterport and Bucksport.	H. Ex. No. 37 52nd Cong. 1st Sess.	R & H Act July 13, 1892
R & H Act Sept. 5, 1896	Channel 90' wide by 2' deep (ext. lw) in Kenduskeag Stream from mouth to Kenduskeag Bridge - deepen Bangor Harbor in front of Boston & Bangor Steamboat Wharf to 11' at extreme low tide.	H. Doc. No. 49 55th Cong. 1st Sess.	R & H Act March 3, 1899
R & H Act Mar. 3, 1899	Removing the "Middle Ground" at Bucksport Harbor to a depth of 16 feet.	H. Doc. No. 275 56th Cong. 1st Sess.	R & H Act June 13, 1902
R & H Act Mar. 3, 1905	Further widening of the harbor at Bangor.	H. Doc. No. 739 59th Cong. 1st Sess.	R & H Act March 2, 1907
July 11, 1947	Declaring Kenduskeag Stream non-navigable.		Public Law 183 80th Cong. 1st Sess.

EXISTING CORPS OF ENGINEERS PROJECT

31. There are two separate Federal navigation projects in Penobscot River. One project is located at Bucksport Harbor, which provides for the removal of obstructing sawdust and mud, from an area in front of the wharves known locally as "Middle Ground", to a depth of 16 feet over an area of about 12.5 acres. This work was adopted in 1902 and completed in 1903 at a cost of $18,421. No maintenance dredging has ever been done on this project although available depths were reported to be only about 6 feet in 1938 and 1964.

32. The second Federal navigation project in Penobscot River includes the entire navigable portion of the river, from its mouth to the Bangor-Brewer area. The project, adopted in 1884, and supplemented by enactments to 1947, provides for a 22-foot deep channel, generally 350 feet wide, from Bucksport to Winterport, a distance of about 6 miles. It also provides for straightening, widening, and deepening to 15 feet, the channel near Crosby Narrows and Sterns Mill. This portion of the river encompasses the area lying between 4.5 and 3.0 miles below Bangor. The project further provides for deepening the harbor at Bangor to 14 feet and widening it along the Bangor waterfront, giving an additional channel width of 100 to 300 feet for a length of about 2,000 feet. The existing project was completed in 1913, at a cost of $292,020. Public Law 183, 80th Congress, 1st Session, dated 11 July 1947, declared non-navigable the Kenduskeag Stream, a tributary of the Penobscot. This waterway had been improved under a prior project.

33. In past years, frequent maintenance dredging in the 22-foot river channel in the vicinity of Lawrence Cove and Frankfort Flats was necessary to remove sawdust and mud bars. These materials were set in motion in times of freshets and were carried downstream, settling out during periods of slack water or low water flow only to be stirred up again during high flow periods. Phasing out of sawmills on the river resulted in the elimination of the sawdust bars and a reduction in the frequency of maintenance dredging. Maintenance dredging was last undertaken in July 1968 when the Government-owned hopper dredge HYDE restored the 22-foot channel opposite Lawrence Cove. This activity removed about 14,500 cubic yards of material at a cost of about $42,000. Reported controlling depths in other portions of the project are 7 feet at Stearns Mill and near Crosby Narrows, and 13 feet at the Bangor waterfront.

LOCAL COOPERATION ON EXISTING AND PRIOR PROJECTS

34. There have been no requirements for local cooperation on the existing or prior projects in Penobscot River. All improvements in the river have been for the benefit of general navigation, and all have been made by the Federal government. However, vessel berthing areas, wharves and piers, and other vessel landing improvements have been provided by local interests.

TERMINAL AND TRANSFER FACILITIES

35. There are two major concentrations of terminal facilities along Penobscot River; one is located in Bucksport and the other is located in the Bangor-Brewer area. In addition, there are several isolated terminals along the river which serve individual needs. These facilities are described as follow, beginning downriver and progressing upstream to Bangor.

36. The Corenco Fertilizer Company operates a bulk fertilizer facility in the Town of Stockton Springs, about 4 miles below Bucksport, on the west bank of the river just above Sandy Point. This plant has a terminal at a T-head type pier, which is in poor condition. There is an overhead conveyor system, which is also in poor condition, for transferring raw materials from vessels to the plant. The facility is easily accessible by road; however, the connecting road would require upgrading for heavy truck operations. Rail access is available via the Bangor and Aroostook Railroad which has a rail spur going directly to the existing pier. Berthing depth alongside the pier is about 17 feet and sufficient open land is available for outside storage or warehouse construction. No waterborne commerce has been reported for this facility since 1968.

37. The concentration of terminal facilities at Bucksport, consisting of commercial operations, is St. Regis Paper Company; C.H. Sprague & Son Company; Central Maine Power Company; and Webber Tanks, Incorporated. The St. Regis Paper Company wharf is a 92' x 405' woodpile and timber pier, with an adjacent line of 8 dolphins. The berthing area was dredged several years ago to 35 feet by the company, and two small dockside derricks can service barges or ships. The company owns two tanks of 55,000 barrel capacity each for storage of residual oil used in plant operation. It is reported that these tanks have been leased to C. H. Sprague & Son, Company. A 90,000 barrel capacity oil tank is owned by the Central Maine Power Company. This tank,

which is located on the river's edge at Bucksport, is also reportedly leased by C. H. Sprague & Son. The C. H. Sprague & Son Company has docking facilities in Bucksport which consist of a line of 5 dolphin clusters spaced about 80 feet apart spanned by a walkway. In 1958 a berth 35 feet deep and 150' x 700' in area was dredged by the company. An oil storage tank having 150,000 barrel capacity is maintained at this location. Between the tanks owned by Sprague & Son and those tanks leased by them, the company has a total oil storage capacity of 350,000 barrels in Bucksport.

38. Webber Tanks, Inc. operates and maintains 5 tanks having a combined storage capacity of 476,000 barrels and facilities for handling tanker ships in the 30'-35' draft range. Petroleum products are transshipped upriver in shallower draft vessels and barges through this facility. In addition, such products are distributed throughout the region via railroad tank cars and overland tank trucks to numerous retail dealers in the Central Maine area.

39. The Northeast Coal and Dock Company owns and maintains a T-head type pier approximately 2 miles upriver from Bucksport Harbor. The pier consists of 9 cluster pile dolphins joined by walkways extending 700 feet along the waterfront. A receiver of coal products until mid-1960, the facility presently receives liquid sulphur from Louisiana in vessels having drafts up to 32 feet. Liquid sulphur is stored in two 10,000 ton liquid sulphur tanks. A conveyor system for unloading coal, and 10 acres of land storage for coal remain as part of the facility, although not now in use for that purpose.

40. Proceeding upstream four miles is the Winterport Marina and Boatyard, Incorporated, located on the west bank of the river in Winterport. The boatyard consists of five large Quonset-type buildings fronted by a wood-pile and timber dock measuring 250 feet long and 40 feet wide. There is a 14' x 36' dock slip, and a 12-ton capacity hoist for hauling pleasure craft. Open and covered storage areas are available for about 150 vessels for winter storage.

41. The Bangor Scrap Iron and Metal Company is located on the westerly bank of the river in South Bangor. Scrap iron is transferred to vessels at the company's bulkheaded waterfront site for export to foreign countries. About 20,000 tons of scrap iron are shipped annually in 10,000 DWT cargo vessels having fully loaded drafts of about 25 feet. Shoal depths at the facility limit vessel capacity to partial loads. Two trips per year are made from this terminal.

42. The remaining active terminals are located in the two-mile reach of the river below the head of navigation in the Bangor-Brewer area. On the east bank of the river in Brewer are located C.H. Sprague & Son, Company; Eastern Fine Paper Co., whose oil storage tanks are reportedly leased by C. H. Sprague; Penobscot Terminal, which reportedly receives no commerce at this time; Citgo Oil Co.; and Gulf Oil Company. Oil terminal facilities on the west river bank in Bangor are Texaco, Inc.; Chevron Oil Co.; Webber Oil Co.; Mobil Oil Corp.; Sun Oil Co.; British Petroleum Oil Co.; and Barrett Paving Materials, a division of Allied Chemical Corporation. A small number of wharves used infrequently by smaller craft are located upstream of the terminal area.

43. In addition to waterfront docking facilities, the concentration of terminals along the Bangor-Brewer reach of the river has rail connections to the terminal areas in Bucksport and Searsport, Maine, allowing for the movement of petroleum products by railroad tank cars.

EXISTING AND PROSPECTIVE COMMERCE

44. Waterborne commerce on Penobscot River to the head of navigation at Bangor consists primarily of petroleum products, with sulphur products running far behind in second place. A comparative statement of traffic for this commerce for calendar years 1965 through 1971, inclusive, is presented in TABLE IV. Prior to 1965, total commerce on Penobscot River had steadily increased from 625,000 tons in 1935, except for decreases experienced during the years of World War II and the Korean conflict.

45. Commodity breakdown as shown in TABLE IV indicates that petroleum products have accounted for over 90% of all reported commerce during the 1965-1971 period, increasing from about 90% in 1965 to about 96% in 1971. On the other hand, second place sulphur shipments had decreased during this same period from about 7% to about 4%. Other commodities such as fertilizer, pulpwood, coal, chemical products, and paper products are either being shipped in relatively small quantities or are no longer being transported by vessel. In the latter case, overland transportation by rail or highway has replaced river movements by vessel.

46. The economic area served by the Penobscot River is similar to those areas served by other major New England ports in that the area

TABLE IV

COMPARATIVE STATEMENT OF TRAFFIC
PENOBSCOT RIVER, MAINE
(Short Tons)

COMMODITY	1971	1970	1969	1968	1967	1966	1965
Sulphur Products	65,619	64,946	75,753	91,597	89,321	98,380	105,594
Crude Tar, Oil & Gas Products	4,000	4,166	11,595	7,469	4,439	8,105	2,680
Gasoline	428,387	364,383	388,526	361,029	383,328	369,468	365,512
Jet Fuel	91,100	76,000	33,820	1,542	------	-------	-------
Kerosene	121,455	101,499	58,788	66,479	76,206	65,546	62,122
Distillate Fuel Oil	505,823	506,456	540,916	514,209	509,952	431,921	432,775
Residual Fuel Oil	519,960	539,569	443,033	435,545	521,160	589,964	529,455
Asphalt, Tar & Pitches	29,720	118,639	27,646	32,862	56,527	50,409	36,346
Fertilizer	------	-------	------	812	------	9,295	3,453
Pulpwood, log	------	-------	------	---	4,400	10,320	29,824
Miscellaneous	6,043	7,369	6,861	4,388	8,691	31,289	19,488
Total Tonnage	1,772,107	1,783,027	1,586,938	1,515,932	1,654,024	1,664,697	1,587,249

is more dependent upon the river for the receipt of waterborne commerce than it is to ship via waterborne means. Manufactured and agricultural commodities are transported out of this economic area by railroad or truck traffic. The only items reportedly shipped by vessel are scrap iron and, to a lesser degree, paper products; consequently shipments play a minor role in total useage of the river.

47. Waterborne commerce data has been supplemented by field contacts with all companies using waterfront facilities along the river. Information obtained indicates that petroleum products are received at terminals at Bucksport or at Bangor-Brewer, and all sulfur products are reportedly received at Northeast Coal and Dock Company in Bucksport.

48. Petroleum products shipped into Bucksport Harbor are destined for either C.H. Sprague & Son or Webber Tanks. Sprague, who reportedly has leased tanks owned by St. Regis Paper Co. and Central Maine Power Co., primarily brings in residual fuel oil for industrial purposes, whereas Webber brings in the more refined products of gasoline, jet fuel and distillate fuel oil. Total combined storage capacity at Bucksport for the two companies is about 825,000 barrels, including the leased tanks. Vessels servicing these facilities range in length from 180 feet to 735 feet with loaded drafts of from 11 feet to 36 feet.

49. The various petroleum products are shipped to the Bangor-Brewer area by small motor vessels and barges varying in length from about 130 feet to 260 feet, with loaded drafts of 11 feet to 14.5 feet. These vessels have capacities ranging from about 8,000 to 13,000 barrels. In some cases, barges will accept a load of product directly from a larger ocean going vessel off the Maine coast, or at one of the facilities in Bucksport. Other times, a vessel will discharge part of its cargo at Searsport or Bucksport until it lightens to a maximum draft of about 23 feet for further transit to the Bangor-Brewer area. For instance, C.H. Sprague & Son, with facilities at Searsport, Bucksport and Brewer, may utilize T-2 type tankers for delivering fuel oil to Brewer after light-loading the vessel at one of the other facilities. At Brewer, this fuel oil is transferred via a 10-inch pipeline to appropriate storage tanks.

50. Ashphalt and tar products are transported to the Barrett Paving Materials Co. facility in South Bangor in relatively shallow draft vessels in the 12-and 13-foot range. Demand for these products can greatly fluctuate depending upon the region's overall construction program. Except for 1970, when 118,639 tons of asphalt, tar and pitches were shipped to the company, the average annual receipt from 1965 to 1971 was 39,000 tons. Future demand for these items will continue to be primarily dependent on highway and other similar construction programs, and such demand is estimated to be within past averages. Furthermore, the limited storage capacity of the existing facility, and the limited capability to handle very large volumes on a rapid pass-through basis, indicate that the existing river channel is sufficient to meet the future needs of the company.

51. The Bangor Scrap Iron and Metal Company uses a liberty ship having a loaded draft of about 25 feet to export accumulated scrap to foreign ports twice a year. Because of shoal water at the company's berthing area, the vessel is partly loaded. A future requirement for increased channel depths to accommodate larger vessels is unlikely.

52. Northeast Coal and Dock Company, owned by Freeport Sulphur Company, ships liquid sulphur to the Bucksport facility from Port Sulphur, Louisiana, in vessels having a maximum reported loaded draft of 32 feet. Vessels average about one trip per month. The quantity of liquid sulphur shipped to this facility has steadily decreased since 1965 when 105,594 tons of this product were reported. This is compared to 1971 reported receipts of 65,619 tons. The average annual tonnage during this seven year period was 84,459 tons. Shipments out of this Bucksport facility are by railroad tank cars and by truck. Company officials anticipate a reversal of this downward trend in future years as the demand for sulphur products increases in the paper manufacturing and other industrial processes. Any increased demand will not substantially affect present shipping techniques and existing river depths are more than adequate to meet foreseeable future needs of the company.

53. As indicated in TABLE IV, and as discussed in paragraphs 44 and 45, the increase in river traffic is attributed to increased receipts of petroleum products. The overall increase of such receipts from 1965 to 1971 was 271,755 tons, an increase of 19%. The major commodities accounting for this increase were gasoline, 17% increase; kerosene, 96% increase; distillate fuel oil, 17% increase; and jet fuel, which accounted for no receipts until 1968 when Bangor International Airport was opened as a public mode of transportation.

54. Forecasts of petroleum demand for the year 2000 have been made by various organizations. The estimated national growth rate for petroleum products is 4.4 percent annually for the period 1970-1980, and 2.2 percent annually for the 1980-2000 period. East coast demand for the period 1970-2000 is estimated to increase almost 2.6 percent annually; 5.9 percent per year from 1970 to 1980, and 2.2 percent per year from 1980 to 2000. In attempting to compare future petroleum demands for the area served by the Penobscot River, the overall economic condition of the Bangor Water Resources Planning Area is taken into consideration, including population trends and industrial growth. Based on these factors it is estimated that petroleum demands for the 1970-1980 period will increase an average of about 2% per year. This figure takes into consideration the fact that jet fuel increases will not continue at the initial growth rate. Average annual increased demand for the 1980-2000 period is estimated at 1.5 percent per year. The decline in the growth rate reflects the anticipated technical solutions for the development of other sources of energy.

VESSEL TRAFFIC

55. Reported vessel trips for the period 1965 through 1971, inclusive, are shown in TABLE V. The deepest draft vessel reported to have transited the river channel was in the 36-foot draft range, and this occurred only once, in 1968. Other than that one trip, maximum draft is in the 35-foot range, which is becoming more common each year. During the 1965-1971 period, the total number of vessel trips having drafts of 30 feet or greater decreased from 37 to 28; however, the number of vessel trips having drafts of 32 feet and greater increased from 16 to 24, and the number of vessel trips having drafts of 34 feet and greater increased from none in 1965 to 19 in 1971.

56. Of the total of 1,315 round trips made in 1971, 1,097 were made by self-propelled vessels and 218 by barges. Included in the 1,097 trips by self-propelled vessels were 710 by tankers, 1 by dry cargo vessel and 386 by towboats and tugboats. All 218 barge trips were made by tanker barges. It is noted that 646 of the 710 self-propelled tanker trips had drafts of less than 20 feet. All deep-draft petroleum traffic which enters Penobscot River for transit to the Bangor-Brewer area is lightened to a maximum of about 23 feet at one of the facilities at Bucksport prior to further movement upriver during high tide periods.

TABLE V

VESSEL TRIPS

Draft (ft.)	1971	1970	1969	1968	1967	1966	1965
36	--	--	---	1	---	---	---
35	3	3	3	1	---	---	---
34	16	6	5	3	4	3	---
33	3	10	6	9	9	8	11
32	2	4	4	5	2	5	5
31	2	4	10	11	9	14	16
30	2	2	4	5	11	8	5
29	6	1	-	2	-	1	1
28	1	1	1	3	5	1	1
27	2	1	1	2	3	4	4
26	2	3	4	3	3	3	3
25	4	3	4	1	1	3	4
24	9	8	9	5	4	4	7
23	7	18	14	12	9	17	28
22	2	9	13	4	10	21	9
21	1	9	6	4	17	9	19
20	2	10	15	4	6	11	8
19	3	13	4	3	6	5	5
18 & less	1,248	1,285	1,067	923	1,110	1,095	1,161
TOTAL	1,315	1,390	1,170	1,001	1,209	1,212	1,287

57. Commercial and sport fishing vessels and pleasure craft are not considered in this study since available depths are adequate for unobstructed passage by such vessels.

58. Although the trend in tanker construction is toward larger capacity vessels, it is highly improbable that petroleum demands of the area could justify employing deeper draft tankers than are presently using this waterway. Other facets pointing towards this conclusion are the limited capabilities of the terminals to handle larger size tankers, and the limited storage capacities along the river, with consideration given to expansion of storage facilities. It is therefore concluded that although increased numbers of tankers in the 32- to 35-foot draft range may be employed to transport petroleum products to the Bucksport area, limiting physical factors at the upriver terminals prohibit extension of this traffic to such facilities, and the present practice of barging or light-loading for transit upriver will continue.

DIFFICULTIES ATTENDING NAVIGATION

59. Information on difficulties attending navigation was furnished by local interests and was supplemented by field observations. Proceeding from the mouth of the river at Fort Point, difficulties being encountered have been reported as follow.

60. Two rock pinnacles are located opposite Sandy Point between Buoys 3 and 5, with minimum depths over the pinnacles of about 31 feet. On 9 January 1962, the tanker ESSO CHESTER carrying a load of fuel oil and drawing about 34 feet of water, struck this previously uncharted pinnacle area. The total cost of this mishap was in excess of $600,000. Since the time of this incident, vessel traffic has been limited to 29 feet at low water; however, with an 11-foot rise of tide, vessels drawing 35 feet pass this area with no difficulty.

61. Narrowing of the channel width above Frankfort Flats and at the bends in the river between Oak Point and Crosby Narrows, and at the Sprague & Son and Eastern Fine Paper facilities in South Brewer, presents maneuvering difficulties to the larger vessels. The absence of appropriate ranges, buoys and other aids to navigation requires familiarity with the river channel and experience in handling the large vessels. Furthermore, great care must be exercised in turning these vessels around in the Bangor-Brewer area because of their size.

62. Re-occurring shoals at Lawrence Cove and Frankfort Flats have in past years reduced controlling depths in these areas by as much as 2-4 feet within a year or two after dredging. Factors favorably affecting the rate of shoaling in these areas are the reduction of sawmill deposits in the river in recent years, and spring freshets which may scour deposits and carry this material into deeper water or out into Penobscot Bay.

63. Freshets occurring in the river during the months of March and April cause dangerous cross currents. Strong ebb tide currents make it desirable for vessels going to Bangor or Brewer to anchor off Fort Point and proceed upstream about 2-3 hours after low tide. Ice interferes with navigation above Winterport about four months of the year, and during extremely cold winters the river is closed on occasion with ice jams forming off the northern end of Verona Island. The U. S. Coast Guard provides ice breaking service to clear the channel when required.

64. The above described difficulties are experienced by existing deep draft vessel traffic moving upriver from Bucksport. Local interests further allege that the existing project depths preclude the use of fully loaded ocean going vessels in the reach above Bucksport, thus hampering the development and growth of new industries that would utilize large vessels.

IMPROVEMENTS DESIRED

65. To determine navigation improvements desired by local interests, a public meeting was held at Bangor, Maine, on 11 June 1968. The meeting was attended by 56 persons representing Federal, state and municipal governments, business representatives, shipping interests, terminal operators and other local interests concerned with navigation improvements of the waterway.

66. The requests for improvements made at this meeting, and improvements subsequently requested were:

a. Dredge the river channel from Fort Point to the highway bridge at Bangor to 40 feet;

b. Widen the channel at the bends to accommodate 40-foot draft bulk carrier having lengths of about 665 feet;

c. Provide sufficient aids to navigation in the way of buoys, ranges and lights to adequately mark the channel;

d. Dredge a turning basin having a minimum depth of 15 feet at mean low water at South Brewer;

e. Remove the rock pinnacles opposite Sandy Point between Buoys 3 and 5.

67. Local interests claimed that the smaller tankers with capacities of 200,000 barrels of petroleum are being phased out of existence and that a premium has to be paid for their continued use to supply the existing terminal facilities. By dredging a channel to a depth of 40 feet, a tanker with a capacity of 300,000 barrels could navigate the river. This would reduce the cost of transportation and thus the price of petroleum products in the area. Local interests agreed that improvement of the channel to accommodate the larger vessels would also require extensive expansion of existing terminal and storage facilities.

WATER POWER AND OTHER SPECIAL SUBJECTS

68. This study does not involve any problems pertaining to water power, flood control or related subjects. The project under review is entirely within tidal waters.

DISCUSSION

69. Improvements requested at the public meeting, and at subsequent meetings with local interests, were concerned with the need for general deepening of the existing Federal navigation project in Penobscot River. The effect any improvements might have on existing commerce was considered, as was the impact on future development of new commerce.

70. On 31 July 1963, only two months prior to the resolution authorizing this study, a review of reports was submitted on Penobscot River pursuant to Congressional Resolutions made in 1956. The result of that study was that provision of a deep-draft channel in Penobscot River to the Bangor-Brewer area was not economically justifiable by the existing and prospective commerce, and the annual benefits were substantially less than the annual charges. A few local interests took exception with the negative results of the study and obtained Congressional interest in having this matter re-studied; hence, the resolution of 3 September 1963.

71. Because of the foregoing, it was necessary that, early in the study period, commitments be obtained from major users of the river, and

any prospective users, to show the intent to utilize an improved waterway to the fullest extent practicable. Such commitments were deemed necessary in view of the general lack of support displayed by most of these same users in earlier years.

72. At the public meeting held in Bangor on 11 June 1968 only one prospective user offered data to substantiate benefits to be derived from an improved waterway; IMC Chlor-Alkali, Incorporated. This company receives shipments of solar salt at Searsport where it is unloaded and transferred to trucks for further shipment to a plant in Orrington. Other general comments favoring an improved river channel indicated the necessity to peruse all areas of commercial interest, including deepening to serve the needs of the petroleum and paper industries along the river. With local aid, a total of twenty companies were determined to use Penobscot River for receiving or shipping goods. Individual contact was made with each of these companies in 1968, and they were queried on their requirements for commercial useage of the river.

73. Of the twenty companies contacted only one, IMC Chlor-Alkali, Inc., could offer supporting data to help formulate justification for the desired improvements. The general lack of interest by the other nineteen companies was for one or more of the following reasons:

a. Existing channel depths to Bucksport are sufficient to meet the needs of all interests in that area;

b. Use of deeper draft tankers to Bucksport is not practicable because of storage capacity and pass-through requirements;

c. Petroleum products are brought into the Bangor-Brewer area by pipeline from Portland and by railroad tank cars from Bucksport and from Searsport, in addition to shipments by shallow draft tankers and barges. Switching to deep draft tankers and eliminating these other modes of transportation was not proposed by local interests;

d. Limited existing upriver storage capacity, with no proposed likelihood for major expansion, does not warrant deep draft movements;

e. Existing upriver waterfront facilities and berthing areas will not accommodate deep draft vessels, and no plans have been proposed to make such improvements;

f. Commodities other than petroleum products are received in relatively small quantities, which could not economically justify the use of deep draft carriers;

g. Present practices of using existing modes of transportation such as rail and highway for transporting dry cargo goods are adequate for forseeable operations.

74. Data obtained during field investigations clearly indicated that any improvement of the waterway would have to be justified on the basis of prospective commerce due to the general lack of interest by the present users. Local interests were informed of the results of our investigation and of the fact that additional data was required concerning anticipated future use of the river. Response indicated that new developments were anticipated in a very short period of time and that additional data would be forthcoming.

75. Towards the end of 1969 it became apparent that no new developments were occurring which would add justification to project improvement, other than known commercial requirements. Local interests were, therefore, informed of the Corps' intent of submitting a report recommending no modification of the existing Penobscot River Federal navigation project. This decision brought forth responses for a further delay pending the submission of additional back-up data.

76. Four years have lapsed since late 1969 when postponement of a final report was requested. Contacts with commercial interests and local officials have resulted in no new data which favorably adds to the study efforts. Perusal of all available information leads to the conclusion that further delay is unwarranted.

76. Consideration has been given to the possibility of industrial growth in the area that would require a deeper river channel than presently exists. No steamship line provides general cargo service into Upper Penobscot Bay; however, several lines now call at Searsport Harbor on a non-scheduled basis. The lack of scheduled ship service is attributable to insufficient or irregular volumes of waterborne commerce moving between this region and other domestic and foreign ports. Steamship lines establish service at ports that generate sufficient cargo to be economically attractive. For a line to establish scheduled or regular service on the Penobscot River, in addition to greatly increased volumes, additional requirements such as improved docking and berthing facilities, warehousing, and necessary unloading and transferring facilities would have to be provided. No indications of such efforts have become evident. Furthermore, shipments from this region to the Portland or Boston area via rail or highway for further shipment by vessel are more economically attractive than providing the required local terminal facilities.

78. Removal of obstructing rock pinnacles opposite Sandy Point between Buoys 3 and 5 was requested by the local river pilots at a meeting subsequent to the public meeting. The desirability of

removing these pinnacles was illustrated by the collison of the tanker ESSO CHESTER with the pinnacles on 9 January 1962, resulting in damages in excess of $600,000. The existence of these pinnacles was not known prior to this incident as they had not been located on previous surveys.

79. Following the report of this accident, surveys were undertaken by the Corps of Engineers and by National Ocean Survey (formerly U. S. Coast and Geodetic Survey) to locate and identify all unrecorded obstructions in the area. These efforts, by fathometer and scanning sonar, resulted in the location and identification of two rock pinnacles opposite Sandy Point providing a least depth of about 31 feet at mean low water. As a result, the river pilots have limited low water passages to vessels having drafts less than 29 feet.

80. The removal of the pinnacles in question to a depth of 35 feet can be justified based upon the elimination of future similar collisions and the associated costs of damages resulting therefrom. However, in investigating this matter it is noted that the existing natural channel adjacent to the pinnacle area has a width of 400-600 feet, which is adequate for existing and prospective traffic. In light of this, and in consideration of the request by the pilots for additional markers, buoys and other aids to navigation, the U.S. Coast Guard was requested to review the system of aids to navigation for Penobscot River from Fort Point to Bangor with particular attention to be given to the practicability of marking the pinnacle area.

81. The Coast Guard has determined that it would be impracticable to install a navigation aid directly on the pinnacles due to site conditions. However, the relocation of the existing BUOYS 3 and 5 to best mark the natural channel to divert traffic around the ledge area presents an acceptable solution to the navigational uncertainties which exist. The local river pilots offered advice and assistance in reaching this solution and they concur in the decisions made. Further questions dealing with existing and proposed aids to navigation are being taken under advisement by the Coast Guard.

CONCLUSIONS

82. An assessment of present and of the prospects for future port-related activities in Penobscot River was undertaken as a basis for estimating potential demand to be made of this waterway. Pertinent available economic and technical data were examined to determine local requirements that could affect the level of waterborne commerce on the river.

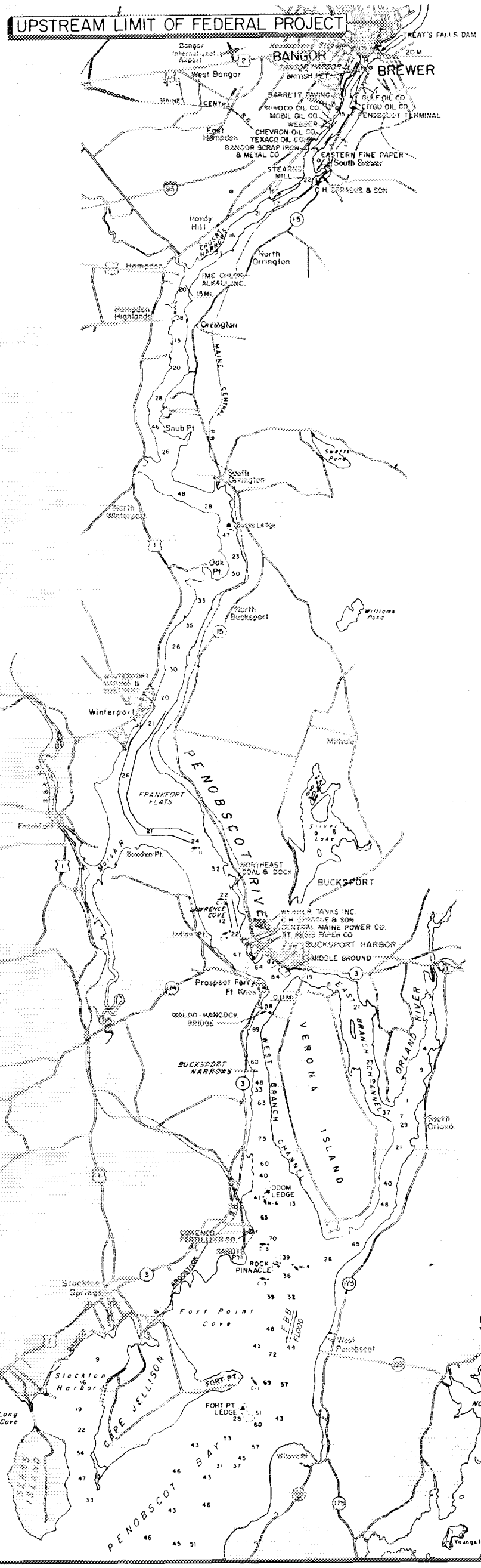
83. Although the tributary area affords several attractive features for port-oriented industries, including an adequate labor force and land development areas, the efforts of local interests to attract such industries have not been successful. Considering the type and level of waterborne commerce, and the anticipated growth of such commerce, it is concluded that the existing Federal navigation project for Penobscot River is adequate to meet foreseeable future requirements.

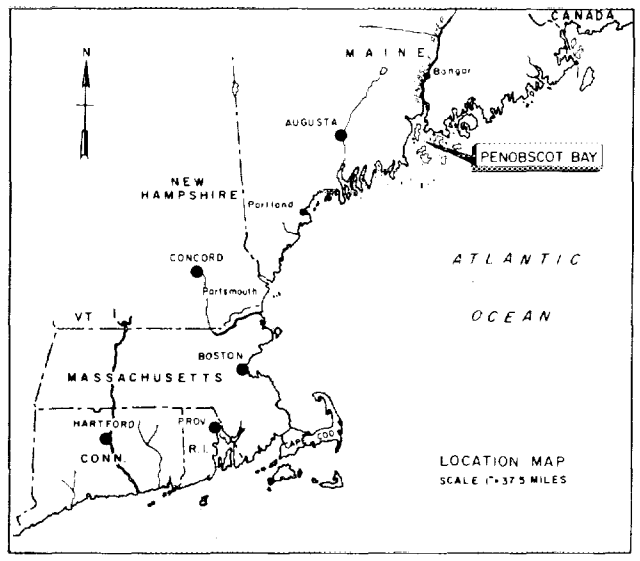
84. Difficulties imposed by unmarked rock pinnacles opposite Sandy Point may be resolved by relocating existing Coast Guard buoys in the area thereby diverting traffic around the pinnacles and through the naturally deep channel. The existing channel width is adequate to enable vessels to maneuver past the area. This relocation of buoys will allow for unobstructed passage of the large vessels apt to use this waterway.

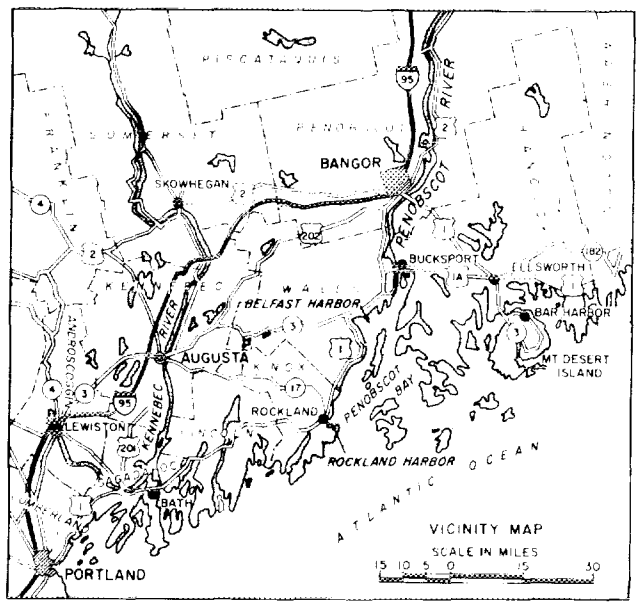
RECOMMENDATIONS

85. In view of the foregoing, the Division Engineer recommends no modification of the existing project in Penobscot River, including Bangor Harbor, nor in Bucksport Harbor at this time.

JOHN H. MASON
Colonel, Corps of Engineers
Division Engineer







NOTES

1. Topography from National Ocean Survey Chart No. 311
2. Depths refer to the plane of mean low water and were obtained from previous surveys
3. U.S. Coast Guard Buoys shown thus C-5
4. Ledge and pinnacle areas shown thus (31)

SCALE

Nautical Miles: 1 1/2 0 1 2

Yards: 1000 0 1000 2000 3000 4000 5000

EXISTING PROJECT

1. Dredge "Middle Ground" in Bucksport Harbor to a depth of 16 feet at mean low water over a 12.5 Acre area
2. Channel 22 feet deep at mean low water, generally 350 feet wide, from Bucksport to Winterport
3. Channel 15 feet deep at mean low water at Crosby Narrows and Stearns Mill
4. Dredge Bangor Harbor waterfront to 14 feet at mean low water

CONSIDERED IMPROVEMENTS NOT RECOMMENDED

1. Dredge Channel 40 feet deep at mean low water from Fort Point to Bangor
2. Dredge a 15-foot turning basin at South Brewer
3. Removal of Rock Pinnacle opposite Sandy Point

REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

DR BY	TR BY	CK BY
	GHD	HM

SUBMITTED _____ PROJECT ENGINEER

_____ CHIEF, COASTAL DEVELOPMENT BRANCH

APPROVAL RECOMMENDED _____ CHIEF, PLANNING BRANCH

APPROVED _____ CHIEF, ENGINEERING DIVISION

DATE JANUARY 1974

PENOBSCOT RIVER AND BUCKSPORT HARBOR, MAINE

TO ACCOMPANY SURVEY REPORT DATED JANUARY 1974

SCALE As Shown

DRAWING NUMBER 1981-D-12-2

SHEET 1 OF 1